CHENG Yongsheng, PENG Cheng, 2014. Petrology and Geochemistry of Liujiang Formation Siliceous Rock in Dachang Ore District, Guangxi, China. *Acta Geologica Sinica* (English Edition), 88(supp. 2): 77-78.

Petrology and Geochemistry of Liujiang Formation Siliceous Rock in Dachang Ore District, Guangxi, China

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1 Introduction

Since the late Proterozoic to Mesozoic, in Guangxi the siliceous rocks were developed, which is one of the distinguishing features of the continental crust active belt in southern China.

From the regional perspective, siliceous rocks of the Devonian in Guangxi is controlled by synsedimentary faulting, particularly in the secondary depression of the fault intersection they developed well, 100-120 m thickness. At the edge of the basin, the thickness of siliceous rocks reduced, but the mudstone and limestone increased.

In Guangxi, the oldest stratum of siliceous rock is Danzhou group Hetong formation of the upper Proterozoic, yet siliceous rocks developed mostly in Devonian Liujiang group.

By using the triangular discrimination diagram of Fe-Mn-(Cu+Ni+Co)Í10^{-6}, Tu (1988) found out that the siliceous rocks in Dachang area corresponded to the hot water sedimentary area, closing to iron end-member, considering its rift valley characteristic, yet with lesser development compared with the eastern Pacific and red sea. Ye et al (1996) thought that in Dachang area the siliceous rocks could be interpreted as the quasi submarine volcanic rocks, belonging to the product of far crater facies or subvolcanic top of volcanic formation, which was related to medium ultrabasic volcanism during the spliting.

About the origin of siliceous rocks，there has been great controversy, including hydrothermal metasomatism, sedimentation, biochemical, etc. Yao and Ding (1994) found that in Dachang there are two kinds of different origin siliceous rocks, (1) Shallow radiolarian cherts, characterized by wide distribution and great thickness, siliceous was derived the dissolved silicon of seawater without direct relationship with mineralization, But their distribution along deepwater Aulacogen indicated indirectly the possible submarine sedimentary exhalation. (2) Rock distribution is more limited, characterized by small thickness and multilayer. The rock was rich in paragenetic mineral, such as feldspar, clay minerals and tourmaline, etc, which could be the submarine exhalative genesis, and closely associated with the sulphide mineralization.

2 Petrology Characteristics

In Dachang ore district, Liu Jiang group is mainly siliceous rock, whose main minerals are composed of quartz, calcite, carbon, clay minerals as well as a few opaque minerals. Quartz is 24% content and mainly anhedral crystal, granular, yet 0.02-0.05 mm for coarse grain, mostly subangular clasts, less than 0.01 mm for the small particles that closely associated with clay minerals and carbon matter. Calcite is 20% content, mainly subhedral-anhedral, granular, 0.01-0.2mm size, partially visible of polysynthetic twin and rhomboid cleavage, mostly irregular aggregates in the size of 0.1-1.5 mm. Carbon matter is 30% content, mainly cryptocrystalline aggregates, closely associated with fine quartz in the form of irregular aggregates. Clay minerals are 25% content, mainly anhedral crystal, irregular shape, less than 0.005 mm grain size. Opaque minerals are 1% content, subhedral, 0.03-0.06 mm size, disseminated distribution. In addition, calcite veins can be observed, which are about 0.01 mm width.

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3 Major Element Geochemistry

Siliceous rocks of Liujiang group mainly contain SiO_2 (51.9%-93.92%; with the average at 81.29%) and secondly Al_2O_3 (0.77%-4.27%; average, 2.06%) as well as Fe_2O_3 (0.34%-1.75%; average, 1.03%). Some samples are characterized by high contents of CaO, yet low SiO_2, such as sample ZK27-2-20 (51.9% SiO_2 and 24.92%CaO), sample ZK101-1-13 (63.57% SiO_2 and 14.8% CaO). Content of other elements are relatively low, including MgO, Na_2O, K_2O, Cr_2O_3, TiO_2, MnO, P_2O_5, SrO and BaO. Overall, rock loss on ignition (LOI) vary in a large range (1.58%-20.9%), among which the maximum is sample ZK27-2-20 (20.9% LOI), followed by sample ZK101-1-13 (11.15% LOI) and sample ZK27-2-12 (13% LOI). According to the relationship of LOI and chemical composition, LOI is interrelated to the content of SiO_2 and CaO. Low SiO_2 and high CaO, LOI is relatively high. The content of CaO has a close contact with organic matter content. In other words, high CaO content can reflect the high organic matter content to a certain extent. High loss on ignition has a certain relationship with lithology, chemical composition and sedimentary environment, etc.

4 Trace Element Geochemistry

Geochemical characteristics of rare earth elements is the effective tracer to explore the formation and evolution of nature various geological body. Cai (1995) pointed out that some domestic large tin deposits, such as Dachang, Gejiu and Xianghualing large tin deposit, etc, are characterized by double origin of granite-stratum. In vein mineralized bodies, the rare earth element distribution characteristics of tin and tin bearing granite are similar, yet in layered mineralized bodies the rare earth element distribution of tin ranges between granite and ore bearing strata, closer to the strata. It is not difficult to find that by contrasting rare earth element distribution pattern of ore mineral, rock and strata, the effective clues to explore the ore genesis can be provided.

Research shows that there are very close relationships between Dachang Devonian strata and the mineralization. To further explore the intrinsic relationship of Devonian strata and deep mineralization and provide new clues for the deep geological prospecting, the rare earth element characteristics and chondrite standardized distribution pattern of the upper, middle and lower Devonian strata was studied for providing some new evidences for prospecting prediction from the perspective of stratum.

Thirteen samples of Liujiang formation for rare earth elements analysis were collected from drilling core of ZK23-1, ZK27-2 and ZK101-1. The results show that ΣREE ranges from 2.98 to 119.09 with an average value of 41.61. LREE is 2.34 to 101.23, being averaged 35.71. HREE is from 0.64 to 17.86, being averaged 5.9. The ratios of LREE/HREE range from 3.60 to 8.97 with an average value of 5.84. The values of $(La/Yb)_N$ is 2.39 to 13.50, being averaged 7.42. The values of δEu and δCe is from 0.48 to 0.96, 0.61 to 1.04, and with the average values of 0.63 and 0.78, respectively.

Acknowledgements

This study was supported by National Natural Science Foundation of China (Grant No. 41202051), Hunan Industrial Science and Technology Support Program (Grant No. S2014GK3005), China Postdoctoral Science Foundation (Grant No. 2012M521721) and the Open-End Fund for the Valuable and Precision Instruments of Central South University, China (Grant No. CSUZC2013021).

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